

AMENDMENTS TO THE CLAIMS

The following listing of claims will replace all prior versions and listings of claims in the application.

LISTING OF CLAIMS

1. (Currently Amended) A lift-and-strike welding process comprising ~~the first~~
 ~~step of:~~

B9 a. cleaning a surface ~~(5)~~ of a component by applying a first voltage so as to strike an arc between a stud ~~(4)~~, which is to be connected to the surface ~~(5)~~, and the surface ~~(5)~~; and

b. reversing the polarity of the first voltage wherein the stud ~~(4)~~ is welded to the surface ~~(5)~~ by ~~means of~~ at least one arc ~~struck by means of~~ generated by a second voltage.

2. (Currently Amended) The process ~~claimed in~~ of Claim 1 ~~wherein~~ further comprising:

a. setting the first voltage higher than a subsequent second voltage of reverse polarity.

3. (Currently Amended) The process ~~claimed in~~ of Claim 2 ~~wherein~~ further comprising:

a. adjusting the first voltage to a positive polarity.

4. (Currently Amended) The process ~~claimed in~~ of Claim 3 ~~wherein~~ further comprising:

a. coating the stud (4) with a lubricant layer ~~for~~ operable with a cold-forming machining operation prior to welding the stud (4) onto the surface (5).

139 5. (Currently Amended) The process ~~claimed in~~ of Claim 4 ~~wherein~~ further comprising:

a. reducing the first voltage to a zero-current state;
b. using a pilot voltage of a different polarity at the start of the welding process; and
c. subsequently raising the voltage to a welding voltage thereafter.

6. (Currently Amended) The process ~~claimed in~~ of Claim 5 ~~wherein~~ further comprising:

a. maintaining the zero voltage for a predetermined period of time, while a second voltage is building up and applying the second welding voltage.

7. (Currently Amended) The process ~~claimed in~~ of Claim 6 ~~wherein~~ further comprising:

139 a. an electric cleaning current ~~flows~~ flowing between a surface (5) of the component and the stud (4) welded thereon with the stud (4) resting on the surface (5);

lifting the stud (4) off the surface (5) ~~up~~ to an approximately constant distance for removing a coating from the surface (5) through ignition of an arc as a cleaning agent;

b. changing the polarity of the current wherein, afterwards, at least one welding current is produced; and

c. welding the stud (4) to the surface (5).

8. (Currently Amended) The process ~~claimed in~~ of Claim 7 ~~wherein~~ further comprising:

a. using a cleaning current of between 15 amperes and 500 amperes; and

b. reducing the cleaning current after the cleaning operation.

9. (Currently Amended) The process ~~claimed in~~ of Claim 8 ~~wherein~~ further comprising:

a. reversing the polarity of the current; and

b. applying a maximum welding current to weld the stud (4) to the surface (5).

10. (Currently Amended) The process ~~claimed in~~ of Claim 9 ~~wherein~~ further comprising:

a. moving the stud (4) into contact with the surface (5) after disconnection of the welding current.

11. (Currently Amended) The process ~~claimed in~~ of Claim 10 ~~wherein~~ further comprising:

a. applying the cleaning current as long as or longer than the pilot current, which is applied prior to applying the welding current.

12. (Currently Amended) The process ~~claimed in~~ of Claim 11 ~~wherein~~ further comprising:

a. applying a welding current that is equal to or stronger than the cleaning current.

13. (Currently Amended) The process ~~claimed in~~ of Claim 12 ~~wherein~~ further comprising:

a. raising the stud (4) to a predetermined distance (S) for cleaning ~~which that~~ is at least two times greater than the distance (S) ~~for welding that the stud (4)~~ is raised above the surface (5) for welding.

14. (Currently Amended) The process ~~claimed in~~ of Claim 13 wherein further comprising:

a. controlling the time period of the cleaning process by measuring the current at the surface ~~(5)~~.

15. (Currently Amended) A ~~Lift-and-strike~~ welding apparatus ~~(1) having comprising:~~

a guide ~~(9) for a weld-on stud (4) and;~~

a control device ~~(10) for the guide (9) and;~~

a programmed device ~~(11) for~~ operable to control or regulate ~~controlling or regulating~~ the electric current and the voltage used for welding, ~~the lift-and-strike welding apparatus (1) comprising: and;~~

a. a welding voltage polarity reversing means ~~(12) reverser device for the voltage used for welding included in~~ operable with the programmed device (11) to provide a cleaning current ~~which that~~ has a ~~reverse~~ polarity ~~compared to~~ opposite that of the welding current that is produced prior to the welding operation.

16. (Cancelled) ✓

17. (Currently Amended) The ~~combination claimed in~~ apparatus of Claim 15 wherein:

a. the programmed device ~~(11)~~ has a focusing device to produce an arc ~~which is~~ to be struck.

18. (Currently Amended) The ~~combination claimed in~~ apparatus of Claim 16
17 wherein:

a. ~~the programmed device (11) has a~~ the polarity reversing means
~~(12) to produce~~ device has a shorted circuit operably ~~for~~ maintaining the struck arc
during a reversal of the polarity.

19. (Currently Amended) The ~~combination claimed in~~ apparatus of Claim 17
18 wherein:

a. the welding apparatus ~~(1)~~ has an evaluation device that operates
during the cleaning operation to inspect the quality of the cleaning.

20. (Currently Amended) The ~~combination claimed in~~ apparatus of Claim 18
19 wherein:

a. the polarity reversing means ~~(12)~~ device has a circuit element; and
b. the circuit element produces an arc current that maintains the
struck arc during the reversal of a polarity of the arc voltage.

21. (Currently Amended) The ~~combination claimed in~~ apparatus of Claim 19
15 wherein further comprising:

13/11 a. a first ~~(13)~~ power source formed in the polarity reversing ~~means~~
device (12) ~~wherein the first power source (13)~~ to supply a cleaning current to the
welding apparatus (1); and

b. a second power source (14) formed in the polarity reversing ~~means~~
~~(12)~~ device to supply a pilot current and a welding current to the welding apparatus (1).

22. (Currently Amended) The ~~combination claimed in~~ apparatus of Claim 20
21 wherein further comprising:

a. a coil ~~(15)~~ ~~is~~ connected to the second power source (14) to
maintain the struck arc during the reversal of the polarity.

23. (Currently Amended) The ~~combination claimed in~~ apparatus of Claim 15
wherein:

a. the surface (5) is formed of aluminum; and
b. the surface (5) has a lubricant coating (8) formed thereon during its
manufacture.

24. (Currently Amended) The ~~combination claimed in~~ apparatus of Claim 15 wherein:

- 1310
- a. the surface (5) is formed of steel sheet; and
 - b. the surface (5) has a lubricant coating formed thereon during its manufacture.
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1311

25. (New) A welding process comprising:

- a. cleaning a surface of a component using a cleaning arc generated by a first voltage; and
- b. reversing a polarity of said first voltage to produce a second voltage that generates a welding arc.

26. (New) The welding process of Claim 25, further comprising:
welding an element to the component using said welding arc.

27. (New) The welding process of Claim 25, wherein said first voltage is greater than said second voltage.

28. (New) The welding process of Claim 25, wherein said cleaning arc is struck between the surface and an element to be welded to the surface.

29. (New) The welding process of Claim 26, wherein the element is a welding stud.

30. (New) The welding process of Claim 25, wherein said first voltage has a positive polarity and said second voltage has a negative polarity.

31. (New) The welding process of Claim 25, wherein the component is aluminum.

32. (New) The welding process of Claim 25, wherein the component is a steel sheet.

33. (New) The welding process of Claim 26, further comprising:
coating the element with a lubricant layer for a cold-forming machining operation prior to said welding step.

34. (New) The welding process of Claim 25, further comprising:
a. reducing said first voltage to a zero-current state; and
b. reversing said polarity of said first voltage to produce said second voltage when said first voltage is at said zero-current state.

35. (New) The welding process of Claim 26, wherein said cleaning step comprises cleaning the surface only in an area where the element is welded to the surface.

36 (New) The welding process of Claim 26, further comprising:

a. setting said first voltage to a zero-current state as the element is moved toward the surface;

b. contacting the element with the surface; and

c. lifting the element from the surface to ignite said welding arc.

37. (New) The process of Claim 25, further comprising:

a. using a first voltage of between 15 amperes and 500 amperes; and

b. reducing said first voltage after said cleaning step.

38. (New) The process of Claim 25, further comprising:

raising the element to a predetermined first distance above the surface to perform said cleaning step that is at least two times greater than a second distance that the element is raised above the surface to perform said welding step.

39. (New) The process of Claim 25, wherein during said reversing step one of said first voltage and said second voltage continuously flows between the element and the surface such that one of said cleaning arc and said welding arc remains lit.

40. (New) A process operable to weld an element to a component, the process comprising:

- B11
- a. contacting the element to be welded to a surface of the component with the surface such that a first voltage flows between the element and the surface;
 - b. lifting the element from the surface to ignite a cleaning arc operable to clean the surface;
 - c. cleaning the surface with said cleaning arc;
 - d. reversing a polarity of said first voltage to produce a second voltage that generates a welding arc; and
 - e. welding the element to the surface using said welding arc.

41. (New) The process of Claim 40, wherein said first voltage is reduced to zero and said cleaning arc is extinguished before said reversing step.

42. (New) The process of Claim 41, further comprising:

- a. contacting the element with the surface for a second time prior to said reversing step; and
- b. lifting the element from the surface subsequent to said reversing step to generate said welding arc.

43. (New) The process of Claim 40, wherein one of said first voltage and said second voltage continues to flow between the element and the surface during said reversing step such that one of said cleaning arc and said welding arc remains ignited during said reversing step.

b1) 44. (New) The process of Claim 40, wherein the element is brought into contact with the surface to generate said welding arc.

45. (New) The process of Claim 40, wherein said first voltage is higher than said second voltage.

46. (New) The process of Claim 40, wherein said first voltage has a positive polarity and said second voltage has a negative polarity.

47. (New) The process of Claim 40, wherein said cleaning step comprises cleaning the surface only in an area where the element is welded to the surface.

48. (New) The process of Claim 44, wherein the element is lifted to a first distance for cleaning during said lifting step occurring prior to said reversing step that is at least two times greater than a second distance that the element is lifted above the surface during said lifting step occurring subsequent to said reversing step.

49. (New) A welding apparatus comprising:
a programmed device operable with a cleaning current and a welding current; and
a polarity reversing device to provide said cleaning current and said welding current with opposite polarities.

β1) 50. (New) The apparatus of Claim 49, further comprising a guide operable to guide said element into contact with said surface that said element is to be welded upon.

51. (New) The apparatus of Claim 50, wherein said guide guides said element into contact with said surface to produce a cleaning arc.

52. (New) The apparatus of Claim 50, wherein said guide guides said element into contact with said surface to produce a welding arc.

53. (New) The apparatus of Claim 49, further comprising a control device operating said guide.

54. (New) The apparatus of Claim 49, wherein said programmed device has a focusing device to produce an arc.

55. (New) The apparatus of Claim 49, wherein said cleaning current produces a cleaning arc operable to clean said surface.

56. (New) The apparatus of Claim 49, wherein said welding current produces a welding arc operable to weld said element to said surface.

57. (New) The apparatus of Claim 49, wherein said polarity reversing device produces a shorted circuit operable to maintain an arc as said cleaning current is terminated and said welding current is activated.

58. (New) The apparatus of Claim 49, wherein said cleaning current is positive and said welding current is negative.

59. (New) The apparatus of Claim 49, wherein said cleaning current is brought to a zero current state before said polarity reversing device converts said cleaning current to said welding current.

60. (New) The apparatus of Claim 49, wherein said cleaning current is powered by a first power source and said welding current is powered by a second power source that is different than said first power source.

61. (New) The apparatus of Claim 49, said apparatus further comprising:
a coil connected to a power source to maintain an arc during operation of
said polarity reversal device.
